

**PCT**WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

|   |           |   |
|---|-----------|---|
| (51) International Patent Classification <sup>7</sup> :<br><b>C07K 14/505, 38/18, A61P 7/06, C12N 5/10, 15/12</b>   | <b>A3</b> | (11) International Publication Number: <b>WO 00/24893</b><br><br>(43) International Publication Date: 4 May 2000 (04.05.00)   |
| <p>(21) International Application Number: PCT/US99/24435</p> <p>(22) International Filing Date: 18 October 1999 (18.10.99)</p> <p>(30) Priority Data:<br/>09/178,292 23 October 1998 (23.10.98) US</p> <p>(71) Applicant: AMGEN INC. [US/US]; One Amgen Center Drive, Thousand Oaks, CA 91320-1799 (US).</p> <p>(72) Inventors: EGRIE, Joan, C.; 561 Dos Vientos Drive, Newbury Park, CA 91320 (US). ELLIOTT, Steven, G.; 1040 Golden Crest Avenue, Newbury Park, CA 91320 (US). BROWN, Jeffrey, K.; 1244 Calle Aurora, Camarillo, CA 93010 (US).</p> <p>(74) Agents: ODRE, Steven, M. et al.; Amgen, Inc., One Amgen Center Drive, Thousand Oaks, CA 91320-1799 (US).</p>  |           | <p>(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b><br/><i>With international search report.</i></p> <p>(88) Date of publication of the international search report:<br/>14 September 2000 (14.09.00)</p> |
| <p>(54) Title: METHODS AND COMPOSITIONS FOR THE PREVENTION AND TREATMENT OF ANEMIA</p> <p>(57) Abstract</p> <p>Methods for increasing and maintaining hematocrit in a mammal comprising administering a hyperglycosylated analog of erythropoietin are disclosed. An analog may be administered less frequently than an equivalent molar amount of recombinant human erythropoietin to obtain a comparable target hematocrit and treat anemia. Alternatively, a lower molar amount of a hyperglycosylated analog may be administered to obtain a comparable target hematocrit and treat anemia. Also disclosed are new hyperglycosylated erythropoietin analogs, methods of production of the analogs, and compositions comprising the analogs.</p> |           |   |

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

|    |                          |    |  |    |  |    |                          |
|----|--------------------------|----|--|----|--|----|--------------------------|
| AL | Albania                  | ES | Spain                                    | LS | Lesotho                                      | SI | Slovenia                 |
| AM | Armenia                  | FI | Finland                                  | LT | Lithuania                                    | SK | Slovakia                 |
| AT | Austria                  | FR | France                                   | LU | Luxembourg                                   | SN | Senegal                  |
| AU | Australia                | GA | Gabon                                    | LV | Latvia                                       | SZ | Swaziland                |
| AZ | Azerbaijan               | GB | United Kingdom                           | MC | Monaco                                       | TD | Chad                     |
| BA | Bosnia and Herzegovina   | GE | Georgia                                  | MD | Republic of Moldova                          | TG | Togo                     |
| BB | Barbados                 | GH | Ghana                                    | MG | Madagascar                                   | TJ | Tajikistan               |
| BE | Belgium                  | GN | Guinea                                   | MK | The former Yugoslav<br>Republic of Macedonia | TM | Turkmenistan             |
| BF | Burkina Faso             | GR | Greece                                   | ML | Mali   | TR | Turkey                   |
| BG | Bulgaria                 | HU | Hungary                                  | MN | Mongolia                                     | TT | Trinidad and Tobago      |
| BJ | Benin                    | IE | Ireland                                  | MR | Mauritania                                   | UA | Ukraine                  |
| BR | Brazil                   | IL | Israel                                   | MW | Malawi                                       | UG | Uganda                   |
| BY | Belarus                  | IS | Iceland                                  | MX | Mexico                                       | US | United States of America |
| CA | Canada                   | IT | Italy                                    | NE | Niger  | UZ | Uzbekistan               |
| CF | Central African Republic | JP | Japan                                    | NL | Netherlands                                  | VN | Viet Nam                 |
| CG | Congo                    | KE | Kenya                                    | NO | Norway                                       | YU | Yugoslavia               |
| CH | Switzerland              | KG | Kyrgyzstan                               | NZ | New Zealand                                  | ZW | Zimbabwe                 |
| CI | Côte d'Ivoire            | KP | Democratic People's<br>Republic of Korea | PL | Poland                                       |    |                          |
| CM | Cameroon                 | KR | Republic of Korea                        | PT | Portugal                                     |    |                          |
| CN | China                    | KZ | Kazakhstan                               | RO | Romania                                      |    |                          |
| CU | Cuba                     | LC | Saint Lucia                              | RU | Russian Federation                           |    |                          |
| CZ | Czech Republic           | LI | Liechtenstein                            | SD | Sudan  |    |                          |
| DE | Germany                  | LK | Sri Lanka                                | SE | Sweden                                       |    |                          |
| DK | Denmark                  | LR | Liberia                                  | SG | Singapore                                    |    |                          |
| EE | Estonia                  |    |  |    |  |    |                          |

## INTERNATIONAL SEARCH REPORT

Inter national Application No  
PCT/US 99/24435

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C07K14/505 A61K38/18 A61P7/06 C12N5/10 C12N15/12

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C07K A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages                                  | Relevant to claim No. |
|------------|---|-----------------------|
| X          | WO 95 05465 A (AMGEN INC)<br>23 February 1995 (1995-02-23)<br>cited in the application<br>claims 1-7,9,17,19,22,23  | 23-32                 |
| A          | claim 10; tables 3,5,6  | 1-22                  |
| X          | WO 91 05867 A (AMGEN INC)<br>2 May 1991 (1991-05-02)<br>cited in the application<br>claims 2,5,9,10                 | 23-32                 |
| X          | EP 0 267 678 A (INTEGRATED GENETICS INC)<br>18 May 1988 (1988-05-18)<br>page 1, line 9 - line 17; claims 1-6<br>-/- | 23-32                 |

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

## \* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&amp;" document member of the same patent family

Date of the actual completion of the international search

28 April 2000

Date of mailing of the international search report

17/05/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Teyssier, B

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 99/24435

| C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT |   |                       |
|--|---|-----------------------|
| Category *   | Citation of document, with indication, where appropriate, of the relevant passages  | Relevant to claim No. |
| A  | US 5 541 458 A (HIRST B MARK)<br>30 July 1996 (1996-07-30)<br>column 6, line 14 - line 22<br>column 8, line 14 - line 23<br>claims 5,6,14,15,17-21  | 1-22,<br>31-37        |
| A  | US 5 716 644 A (BRICKNER AVRAM ET AL)<br>10 February 1998 (1998-02-10)<br>column 1, line 23 - line 48   | 1-22,<br>31-37        |
| A  | FIBI M R ET AL: "N- AND O-GLYCOSYLATION<br>MUTEINS OF RECOMBINANT HUMAN<br>ERYTHROPOIETIN SECRETED FROM BHK-21CELLS"<br>BLOOD,<br>vol. 85, no. 5, 1 March 1995 (1995-03-01),<br>pages 1229-1236, XP002053700<br>page 1235, last paragraph         | 1-37                  |
| A  | EGRIE J C ET AL.: "The role of<br>carbohydrate on the biological activity of<br>erythropoietin"<br>GLYCOCONJUGATE JOURNAL,<br>15 - 20 August 1993, page 263 XP000906829<br>Abstracts of XIIth International Symposium<br>cited in the application |                       |
| A  | ELLIOTT STEVE ET AL.: "Structural<br>requirements for addition of O-linked<br>carbohydrate to recombinant<br>erythropoietin."<br>BIOCHEMISTRY,<br>vol. 33, no. 37,<br>17 September 1994 (1994-09-17), pages<br>11237-11245, XP000906783           |                       |
| P,X  | WO 99 11781 A (FIBI MATHIAS ;HERMENTIN<br>PETER (DE); HOECHST MARION ROUSSEL DE<br>GMBH) 11 March 1999 (1999-03-11)<br>claims 1-5,8-10,12,14-19,22  | 23-31                 |

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 99/ 24435

## Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:  
Remark: Although claims 1-22 and 32-37 are directed to a method of treatment of the human/animal body, the search has been carried out and based on the alleged effects of the compound/composition.
2. ☒ Claims Nos.: 1, 7, 33, 35  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:  
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

## FURTHER INFORMATION CONTINUED FROM PCT/SA/ 210

Continuation of Box I.2

Claims Nos.: 1, 7, 33, 35

Present claims 1 and 33 on one hand and 7 and 35 on the other hand relate to the administration of compounds characterised (inter alia) by reference to the frequency and dose of administration, respectively. In this context, the wordings "less frequently" and "lower molar amount" with reference to prior art recombinant human EPO were not considered clear within the meaning of Article 6 PCT. Consequently, with respect to claims 2, 8, 34, 36 and line 14, page 4 of the description, the search has been restricted to "two times a week or less" (claim 1) or "one time a week or less" (claim 33) and "total molar amount of less than of 4.5 mug/kg/week or 150 units/kg/week" (claims 7, 35), respectively.

# INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No

PCT/US 99/24435

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|---|---------------------|----------------------------|---------------------|
| WO 9505465 A                              | 23-02-1995          | AT 155796 T                | 15-08-1997          |
|   |                     | AU 677097 B                | 10-04-1997          |
|   |                     | AU 7632794 A               | 14-03-1995          |
|   |                     | CN 1105030 A               | 12-07-1995          |
|   |                     | CZ 9500917 A               | 13-03-1996          |
|   |                     | DE 69404401 D              | 04-09-1997          |
|   |                     | DE 69404401 T              | 19-02-1998          |
|   |                     | DK 640619 T                | 02-02-1998          |
|   |                     | EP 0640619 A               | 01-03-1995          |
|   |                     | ES 2105442 T               | 16-10-1997          |
|   |                     | FI 951792 A                | 18-05-1995          |
|   |                     | GR 3024815 T               | 30-01-1998          |
|   |                     | HK 1001589 A               | 26-06-1998          |
|   |                     | HU 72849 A                 | 28-05-1996          |
|   |                     | JP 11155584 A              | 15-06-1999          |
|   |                     | JP 2938572 B               | 23-08-1999          |
|   |                     | JP 8506023 T               | 02-07-1996          |
|   |                     | LV 10972 A                 | 20-12-1995          |
|   |                     | LV 10972 B                 | 20-10-1996          |
|   |                     | NO 951445 A                | 16-06-1995          |
|   |                     | NZ 273134 A                | 24-11-1997          |
|   |                     | SI 640619 T                | 28-02-1998          |
|   |                     | SK 50295 A                 | 09-08-1995          |
|   |                     | ZA 9406122 A               | 20-03-1995          |
| WO 9105867 A                              | 02-05-1991          | AT 146187 T                | 15-12-1996          |
|   |                     | AT 184914 T                | 15-10-1999          |
|   |                     | AU 646822 B                | 10-03-1994          |
|   |                     | AU 6604290 A               | 16-05-1991          |
|   |                     | CA 2027635 A               | 14-04-1991          |
|   |                     | CA 2165694 A               | 14-04-1991          |
|   |                     | CN 1051936 A               | 05-06-1991          |
|   |                     | DE 69029370 D              | 23-01-1997          |
|   |                     | DE 69029370 T              | 05-06-1997          |
|   |                     | DE 69033301 D              | 28-10-1999          |
|   |                     | DE 69033301 T              | 20-04-2000          |
|   |                     | DK 428267 T                | 09-06-1997          |
|   |                     | EP 0428267 A               | 22-05-1991          |
|   |                     | EP 0668351 A               | 23-08-1995          |
|   |                     | ES 2097753 T               | 16-04-1997          |
|   |                     | FI 964648 A                | 21-11-1996          |
|   |                     | GR 3022658 T               | 31-05-1997          |
|   |                     | HK 1006718 A               | 12-03-1999          |
|   |                     | JP 8151398 A               | 11-06-1996          |
|   |                     | JP 2983629 B               | 29-11-1999          |
|   |                     | JP 4502331 T               | 23-04-1992          |
|   |                     | NO 301832 B                | 15-12-1997          |
|   |                     | NZ 235676 A                | 28-04-1992          |
|   |                     | PT 95586 A, B              | 30-09-1991          |
|   |                     | US 5856298 A               | 05-01-1999          |
|   |                     | ZA 9008166 A               | 28-08-1991          |
| EP 0267678 A                              | 18-05-1988          | US 4954437 A               | 04-09-1990          |
|   |                     | AU 7842987 A               | 16-03-1989          |
|   |                     | DK 478287 A                | 16-03-1988          |
|   |                     | FI 873897 A                | 16-03-1988          |
|   |                     | JP 63185396 A              | 30-07-1988          |
|   |                     | PT 85699 A, B              | 01-10-1987          |



# INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter. Application No

PCT/US 99/24435

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s)  | Publication<br>date  |
|---|---------------------|---|--|
| US 5541458 A                              | 30-07-1996          | EP 0712207 A<br>JP 8256478 A  | 15-05-1996<br>01-10-1996   |
| US 5716644 A                              | 10-02-1998          | AU 705451 B<br>AU 5972496 A<br>AU 705968 B<br>AU 6034196 A<br>CA 2223583 A<br>CA 2223834 A<br>CZ 9703908 A<br>EP 0871433 A<br>EP 0831786 A<br>JP 11506764 T<br>NZ 309533 A<br>PL 323736 A<br>WO 9640073 A<br>WO 9640074 A<br>AU 698016 B<br>AU 4275597 A<br>AU 680422 B<br>AU 4630893 A<br>CA 2136434 A<br>EP 0644771 A<br>JP 7507806 T<br>WO 9325221 A<br>US 5674534 A | 20-05-1999<br>30-12-1996<br>03-06-1999<br>30-12-1996<br>19-12-1996<br>19-12-1996<br>13-05-1998<br>21-10-1998<br>01-04-1998<br>15-06-1999<br>30-08-1999<br>14-04-1998<br>19-12-1996<br>19-12-1996<br>22-10-1998<br>15-01-1998<br>31-07-1997<br>04-01-1994<br>23-12-1993<br>29-03-1995<br>31-08-1995<br>23-12-1993<br>07-10-1997 |
| WO 9911781 A                              | 11-03-1999          | EP 0902085 A<br>AU 9533798 A  | 17-03-1999<br>22-03-1999   |